

INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 2003	Park: Shenandoah NP
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Permit#: SHEN-2002-SCI-0023	
Park-assigned Study Id. #: SHEN-00271	
Project Title: Field Measurements of Metabolic Indices During Hiking	
Permit Start Date: Mar 15, 2002	Permit Expiration Date May 31, 2008
Study Start Date: Mar 15, 2002	Study End Date May 31, 2008
Study Status: Continuing	
Activity Type: Research	
Subject/Discipline: Other	
Objectives: I plan on hiking this section of the AT twice in order to compare metabolic differences when hiking with and without trekking poles. At the same time time, I will be using the newest generation of triaxial accelerometers that allows long-term measurement of physical activity. The accelerometer records activity counts in three planes of movement, which are used as the basis to estimate energy expenditure. Several outcomes will result from this project. First, it provides a way to map the AT in terms of energy expended and thus lends additional information for planning in terms of food (calories necessary) and overall effort. Second, it provides an extended analysis of the overall effect trekking poles have in terms of energy expenditure during backpacking. Third, it will provide a field comparison of measuring metabolism directly or indirectly via the Cosmed K4b2 metabolic unit versus the RT3 Triaxial Accelerometer. The combination of these instruments allow for more realistic field measurements of energy expenditure. A unique feature of the Cosmed K4b2 is the inclusion of a 12 channel GPS unit that integrates speed, distance, and altitude with the metabolic data. Other extensions for this project are being considered as well. In my conversations with the head ranger of Geographic Information Systems for the Shenandoah National Park, he expressed interest in developing a grading system for all of the trails in the park based on measures of energy expenditure. In an effort to assist park visitors with accurate hiking information, a rating scale can advise hikers of the actual difficulty of trails they choose to hike. Obviously, this aspect of the study would be a long-term project. The results of this study will be disseminated through subsequent publications and presentations.	
Findings and Status: The following abstract has been accepted for presentation at the National Convention of the American College of Sports Medicine in Indianapolis, IN on June 3, 2004. Metabolic Responses During Appalachian Trail Backpacking With and Without Trekking Poles	

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The advent of portable metabolic units has extended energy expenditure measurement to field settings. However, relatively few studies have investigated the energetic demands of backpacking activities outside the laboratory. **PURPOSE:** To compare the metabolic responses of backpacking with and without trekking poles during section hiking on the Appalachian Trail. **METHODS:** The subject for this case study was a 51-year-old male backpacker (72 kg, 173cm, VO₂peak 52.7ml.kg⁻¹.min⁻¹). Breath by breath respiratory data was measured using a K4 portable metabolic unit during two hikes of a ten-mile section of the Appalachian Trail, walked at a self-selected pace with and without trekking poles. Energy expenditure (EE), ventilation (VE), breaths/min (BM), respiratory exchange ratio (RER), heart rate (HR) and changes in altitude were averaged over one minute intervals during both hikes. Altitude data was measured with integrated GPS software of the metabolic unit. Responses in dependent measures were compared between trials using ANCOVAs, with altitude change as the covariate. **RESULTS:** When comparing trekking poles versus no poles, all dependent measures showed parallel slopes between trials with respect to change in altitude ($p > 0.05$). The y-intercepts were not significantly different between poles and no-poles, respectively, for EE (5.86 vs 6.31 kcal.min⁻¹; $p = 0.162$) and BM (27.5 vs 26.5; $p = 0.254$). Alternatively, the y-intercepts for HR (113.0 vs 120.7 beats/min; $p < .0001$), VE (35.8 vs 38.1 L/min; $p = .0042$), and RER (.81 vs .87; $p < .0001$) were all significantly higher for the non-pole condition. Overall rating of perceived exertion was also lower during the pole condition. **CONCLUSION:** While overall energy expenditure did not differ between conditions, the use of poles positively affected various responses to backpacking. It is plausible that the use of poles altered the muscular distribution of work in a way that eased the perceived effort of the activity. In this case, portable metabolic units appear to have considerable utility for examining backpacking related research questions in the future. Moreover, using one-minute averages over varied terrain affords a coherent approach to accounting for the effects of gradient in the analysis thereby providing a more meaningful comparison

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For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:

0

Funding provided this reporting year by other sources:

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Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college

Full name of college or university:

n/a

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